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THE JOURNAL OF THE ASSOCIATION OF COLLEGIATE ALUMNAE

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The
Journal of the Association of
Collegiate Alumnae

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HEREDITY AND PROBLEMS IN EUGENICS

A REPORT OF THE SUBCOMMITTEE ON EUGENICS

EFFA FUNK MUHSE

The Association of Collegiate Alumnae has called for a report on eugenics. The subject requires careful consideration, not only because of the prominence it has attained, but also because of the far-reaching significance of its principles; accordingly a strictly scientific presentation is highly important. At the present time thousands are glibly using the term and advocating so-called eugenic measures while not even tens have a scientific understanding of the subject; absence of correct knowledge is so evident that the few who really comprehend the field are slow to urge organizations to start on constructive work. They are certain, however, that real progress can be made by aiding in the diffusion of accurate information pertaining to the principles of eugenics and in the critical analysis of suggested eugenic measures. There has as yet been very little opportunity for the dissemination of correct information on this subject. The colleges, even, with the exception of a very few that earlier instituted courses because of research interests in heredity, are only just beginning to offer adequate courses to the general student body.

The chairman of this committee is firmly convinced that the membership must obtain a clear, general knowledge of the field of eugenics as the first requisite of future effective work on the part of the Association, and accordingly wishes to make one recommendation for the coming year, viz.: that each local chapter devote two meetings to the subject—the first, to the study of the Mendelian principles of heredity, and to early embryonic development; the second, to a discussion of anti-eugenic agencies and practices, and of suggested remedial measures. As an aid to carrying out this recommendation the chairman appends a short list of literature and addresses that can be used to advantage, and offers the following paper as a suggestive basis for study.

For convenience of reference, the writer has divided this discussion into three parts: (I) eugenics defined, and its field distinguished from

that of euthenics; (II) heredity explained in the light of Mendelian cytological researches; and (III) eugenic measures suggested by careful students of the subject.

I. Measures intended to bring about race improvement have been advocated throughout the ages. The past half-century, however, has seen the growth of a distinct science, now called genetics, one of whose subdivisions is eugenics. Genetics is the study of the laws of heredity and their application in the improvement of the human race, animals, and plants. Eugenics refers particularly to the human race, and is defined as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally." The name of Gregor Johann Mendel is intimately associated with the science of genetics, as is that of Francis Galton with eugenics. It is, moreover, a coincidence that each of these men was born in 1822; also that each submitted to the public in 1865 his first statements on these then unnamed subjects.

Mendel, at that time, as the result of eight years of most careful experimentation in crossing so-called varieties of the edible pea, announced a definite law of heredity made up of three principles. In all the years intervening between 1865 and 1900 the known literature makes only one reference to his work, but thanks to that mere mention and the perpetuation of the reference, three scientists were led in the latter part of the century to search out Mendel's publication. Recognizing that his law, if correct, was of the greatest importance, each proceeded to repeat his experiments on peas. The result was that in 1900, within a few months of each other, these three men—DeVries, of Holland; Correnz, of Germany; and Tschermak, of Austria (not one of whom knew that others were at work on the problem)—published independently the verification of the principles Mendel had established. These are now commonly spoken of as the "Mendelian principles of inheritance," too late, however, to have brought satisfaction to Mendel himself, for he died in 1884, bitter in his disappointment that none of his contemporaries had recognized the great significance of his conclusions. The Mendelian rediscovery was the stimulus for a great amount of work along the same and related lines. Accordingly, since 1900, chiefly in England and the United States, many plant- and animal-breeding experiments, dealing with various physical characteristics, have been carried on; exceedingly valuable contributions have been made on the minute structure of sex cells, and on the functions of their parts; and much has already been learned regarding the inheritance of human traits through the extensive family histories that have been compiled. Bateson, of England, less than a decade ago, gave to this epoch-making work the name of genetics.

The history of eugenics, on the other hand, is quite different. Following the publication in 1859 of Darwin's *Origin of Species*, Galton's thoughts, like those of many other scientists, were turned into new channels. He at once started work on the subject of human heredity, and having satisfied himself that mental characters, as well as physical, are inherited, he published two articles in *Macmillan's Magazine* of 1865 setting forth his conviction that race improvement is wholly dependent on good heredity. In *Memories of My Life*, 1908, he states that these articles contained the germs of all his future work on this subject. It was in 1884, in his book *Human Faculty*, that he first used the word "eugenics," newly coined by him to mean good birth, or the improvement of the race through breeding. It was in 1904 that he formulated the definition quoted above; in his last book he speaks of it as being thus "officially defined," and needless to say this is now the accepted definition. Galton, unlike Mendel, lived sufficiently long to see the central idea on which he had insisted for nearly half a century quite generally accepted. It was, moreover, during the last decade of his life that the invaluable genetic knowledge above referred to made that great progress which is furnishing to eugenists the foundation principles whereby the race can be improved.

The crucial expression in Galton's definition is that of "racial qualities," but, aside from biologists, this fact is appreciated only by a limited number of those who are advocating eugenics. It is necessary at this point to encroach, for a moment, on the second division of the paper. We shall then be in a better position to define racial qualities, and to make a clearer statement of the relation of heredity and environment to race improvement.

When two human sex cells—each in reality a half-cell—unite to form the fertilized ovum, two lines of descent are brought into relation, and barring accident their continuance is thus insured for at least another generation. This completed cell soon divides into two identical cells, and each in turn divides, etc., until a cluster is formed; division continues, and a hollow sphere, the wall made up of a layer of cells, is the next stage. With further division, folding begins and the future human being commences to take form. All this happens within the first few days of pregnancy. At some stage during this early period, one cell—known as the primordial germ cell—ceases to divide and rests for a time. It is destined to give rise to the primary oöcytes or spermatocytes of the sex organs of the developing embryo. They, in turn, rest till after adolescence comes on, when each from time to time gives rise to functioning sex cells. During the first days, then, of embryonic development, the primordial germ cell parts company, as it were, from the remaining cells that differentiate to form the tissues of the individual's body, the

soma. After this early separation, there is no evidence of any relation between the germplasm and the somatoplasm, other than that the latter serves as the carrier for the former—a relation similar to that existing between a bottle and the contained liquid, as one scientist expresses it. The interesting, important, and accepted conclusion, accordingly, is that a child does not inherit anything from the body of the parent, but that the child and the parent resemble one another only because they have each inherited something from the same continuous stream of germplasm.

The first principle, then, of the Mendelian law is that an individual's inheritance consists of numerous traits or unit characters, which are for the most part independently inherited—characters that are structural, physiological, moral, and mental in nature, such as tallness, brown eye-pigment, strong lung tissue, etc. The second is that for a character to appear in the body it must previously be represented by a so-called determiner, in one or both of the sex cells that unite in the fertilized ovum. The third principle is that the various determiners present in the sperm and egg that unite at fertilization keep their identity, and when the sex cells are formed they in turn receive the contribution from each ancestral line independently of the other.

A racial quality, therefore, is one that is inherited, one that has its basis in germplasm. Social workers, dealing as they do chiefly with the unfortunate of society, and physicians, constantly associated as they are with the diseased, emphasize the improvement of environment as of utmost importance. The statements of many, however, make it evident that they take it for granted that the bodies of future individuals can receive the cumulative effect of the conditions, good or bad, through which their parents, and even grandparents, have lived. Biologists, however, cannot agree with this idea to which the scientific evidence is practically all opposed. There is as yet no satisfactory explanation of how new characters arise in nature, or of how the basis or determiner for a character is first introduced into the stream of germplasm. Since the present knowledge is confined to certain characters about which definite genetic conclusions have been reached, the only claim that the student of heredity makes is that, given one of these characters and a knowledge of its history in two strains to which a pair of prospective parents belong, the relative proportion of children that may be expected to receive the character in question can be predicted in advance.

To the biologist, then, the improvement of the individual, or even of a whole generation, does not help to insure race improvement. Racial qualities or characters, as said above, are wholly dependent on the nature of the germplasm or sex cells. Consequently, with our present knowledge, the improvement of the race will consist wholly in establishing

a higher average of humanity. The only logical method of accomplishing this task is to bring about such social and economic conditions as will enable more germplasm of good quality to perpetuate itself and will prevent the continuance of germplasm that is known to have serious defects or very bad qualities.

The development of the race must not be confused with that of the individual. In regard to an individual's own development, during his or her lifetime, an accurate estimate cannot be made of the relative value of nature or heredity and of nurture or environment, which is here broadly used also to include training and accumulated knowledge. Galton held the idea that, as far as the individual is concerned, nurture has only nature to build upon and can add nothing new; and on the other hand, that nature is wholly dependent on nurture to secure final results. David Starr Jordan expresses it thus: "All our schools, our art, science, religion, have their justification as part of our nurture. Still, at the end nurture can only develop what was there through nature. Education, training, can make nothing new, and neither can leave any traces we can recognize on the germs of life, which show their development in generations to come."

In other words, the individual who inherits bad characteristics may possibly show improvement if the best surroundings are provided—e.g., one mentally defective may be trained to be of some use through his or her remaining years; and the tubercular person from a tuberculous strain may, by proper care, continue to live to old age. But it is only the body cells that respond to the improvement; the sex cells pass on to succeeding generations only what they received from the previous one. On the other hand, the person whose sum-total of inheritance is good or valuable to society may be greatly injured for the rest of life by bad environment—mutilation, disease, vice, starvation, etc.,—or may remain undeveloped through lack of training.

It should be borne in mind, however, that the pregnant mother and the developing embryo may be similarly affected by the same environment, as for example by the lack of or overabundance of food. But it is erroneous to call the evidence of such influence the child's inheritance, since the body cells alone have been affected. In those cases where the body of a parent, previous to a child's birth, contains one of the so-called racial poisons—alcoholic, lead, or syphilitic—the latter's body may also show bad affects attributable to the poison. Little, however, is as yet definitely known about the influence of such poisons on the child's germplasm and whether the sex cells are thus ever deprived of determiners for unit characters. The child that is born with syphilis has it because of prenatal infection. It is probable that the child comes from a strain that is more susceptible to the syphilitic germ than many other

children, which, scientifically speaking, is its only inheritance in this regard. Children one or both of whose parents are alcoholic may at birth be found to be diseased or otherwise abnormal. This is probably due to bad prenatal environment. But if such a child finally becomes an alcoholic there is reason to believe that this is due rather to an inherited lack of resistance to alcohol, the same that permitted of the parents' drunkenness before or at conception, or of the mother's during pregnancy. Compare the two degenerate strains, the "Jukes" and the "Ishmaelites," one notably given to drunkenness, the other practically free from it, and both living under equally bad environmental conditions. Further, take the case of those who lead a loose or depraved sex existence—the men and women who make prostitution a serious social question. It is safe to say that an equal number of both sexes are moral degenerates because of bad inheritance, because they are born of defective strains. Established facts, on the other hand, show that some of the women of the prostitute class are there because of economic conditions, force, choice, etc. The majority of boys and men, however, who indulge in such practices do so merely because of tradition, because they have never been led nor expected to think differently on this subject. It is highly important then to recognize the two explanations for sex prostitution—heredity in the case of some men and women, environment in the case of a few women and many men—and not to consider the question as falling wholly within the field of eugenics. It is, in fact, most unfortunate for the eugenic movement that among so many people the central idea of heredity has been confused and obscured by the demand for sex-hygiene teaching. It has long been known that proper sex instruction and clean living are highly important, but the use of the term "eugenics" to cover a subject so largely environmental in nature only helps to throw into the background the recently acquired knowledge of heredity and to retard the correct application of its principles—the very foundations of eugenics.

Enough has surely been said to emphasize the necessity for making a distinction between heredity and environment. It is quite true that "if we can build up life, life will build up all other things"; but it insures more rapid progress when nature and nurture work together. A remarkable service was rendered by Mrs. Ellen Richards when, shortly before her death, she introduced the term "euthenics." There is no place in this discussion for an analysis of Mrs. Richards' attitude toward what constitutes race improvement, nor of her estimate of the relative value of the two fields eugenics and euthenics. The important thing is that this new term can be made to serve a splendid purpose in helping to diffuse the idea of the necessity for making a distinction between heredity and environment. *Euthenics, the Science of Controllable Environment*

is the title of her book published in 1910. "The betterment of living conditions, through conscious endeavor, for the purpose of securing efficient human beings, is what the author means by euthenics." Fortunately the Association of Collegiate Alumnae has already recognized this distinction by the appointment of a General Committee on Home Economics, two of whose subcommittees report respectively on eugenics and euthenics.

II. Since an appreciation of the field of eugenics is dependent on a knowledge of the laws of heredity, and on an understanding of the mechanism whereby traits are inherited, these two phases will here be discussed at some length. As said above, the body or soma is merely the carrier of the sex cells with which rest the inheritance of all future individuals in given lines of descent. The human egg is very minute and the human sperm is but a fractional part as large (Fig. 1). The

FIG. 1.—Human sex cells and fertilization. The head of the sperm enters the egg, enlarges into a nucleus similar to that of the egg, and unites with it.

marked difference in size and shape is due to the fact that the egg contains a supply of food, while the sperm is so constructed as to have the power of locomotion. The nucleus of each, however, is practically identical, and this is the part of the cell with which we are concerned in heredity. It appears as a spherical mass which seems to consist, when artificially stained, of a densely colored network of granules, called chromatin, whose spaces are filled with a clear, homogeneous substance.

Fertilization (Fig. 1) consists in bringing the chromatin material of the two nuclei into the closest possible proximity—I say proximity because, while they unite to form one nucleus, it is not likely that there is any actual blending of the chromatin substance. The divisions succeeding fertilization, and earlier spoken of as constituting the beginnings of the new life, are accomplished by a method which aims to divide the nuclear substance into identical halves (Fig. 2). The chromatin collects into a skein which next breaks up into rod-shaped bodies called chromosomes, sixteen in the case of human beings. They then arrange themselves in a group, or so-called plate, at the center of the nucleus, midway between two starlike bodies which are connected by a spindle of fine protoplasmic threads. Soon all the chromosomes split longitudinally

into halves which pass respectively to the two ends of the spindle where they break up into a network, at the same time that the entire cell is completing its division into two small ones. One is thus in every way a duplicate of the other. This is always the method of division

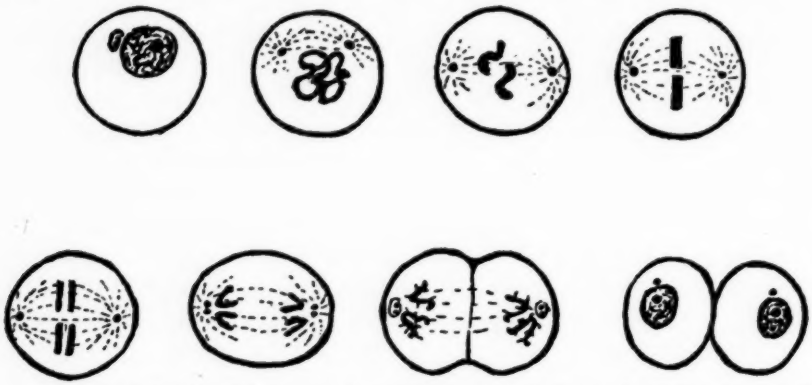


FIG. 2.—Mitosis. Diagrammatic representation of the method whereby a cell and its chromatin is divided into identical halves. Only one pair of chromosomes is here shown. (After Wilson.)

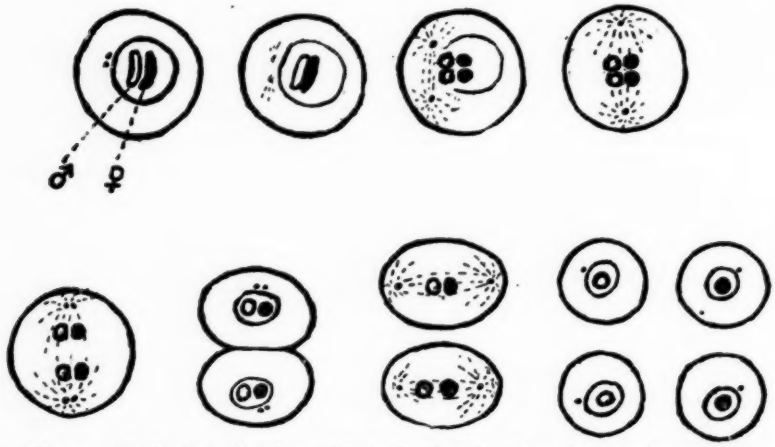


FIG. 3.—Reduction division. Method whereby four functioning sperms are formed from one primary spermatocyte, and the chromosomes reduced to half the number characteristic of the species. Only one pair of chromosomes is shown in the primary spermatocyte. (After Boveri.)

among healthy cells, except when the final cells are formed from the resting oöcyte or spermatocyte, and then a method of reducing the chromatin by half ensues (Fig. 3), which is as follows: The sixteen chromosomes of the cell, the eight originally contributed by the mother and the eight by the father, come together in pairs and apparently unite.

Each so splits that four small spheres result; they remain together and form what is called a tetrad. The eight tetrads thereupon pass to the center of a spindle, which in the meantime has formed, and two parts of each go in one direction, and the remaining two in the other. In the two newly formed cells, the eight dyads then gather at the center of a spindle and the parts of each separate, one going in either direction, and again two cells are formed. Note that four functioning cells are thus formed from the one spermatocyte (only in the division of the food mass does the oöcyte differ, and this we will not here discuss). Also note that of each tetrad which was originally made up from a chromosome from each parent, one-fourth goes to form a single chromosome in each of the four final cells. By this method the chromatin is not only rearranged but is so reduced that each sex cell contains only half the regular number of chromosomes.

With this brief description of the microscopic structure and of the physiological actions of the sex cells before us, let us again call to mind the Mendelian principles: first, that our inheritance consists of numerous independent traits or unit characters; secondly, that each is represented in the germplasm by a determiner, i.e., by something which merely represents without resembling the character that will later develop. The various determiners seem to bear a very definite relation to the chromosomes. The third principle is that of the segregation of the determiners when the sex cells are formed. A sex cell of an individual never receives more than one determiner for the same character, and that from one or the other parent, but not from both.

The person who receives a determiner from each parent for a character is said to be duplex in that one respect and all his or her sex cells will each and every one in turn contain a determiner for the character. The person who receives a determiner from one parent only is said to be simplex, and but half of his or her sex cells will each receive a determiner. The person who does not receive a determiner for the character from either parent is said to be nulliplex, and none of his or her sex cells can possibly carry the determiner in question. Thus with regard to a single characteristic that is completely dominant or nearly so, the bodies of individuals are of two kinds—either they show or they do not show the character. In respect to the sex cells of these same individuals there are three possibilites—all bear a determiner for the character in question, half bear it, or none bear it. With regard to a single characteristic there are accordingly six possible matings (Fig. 4).

The subject of dominance may be spoken of at this point, and the well-understood physical characteristic of eye-color, a much-used illustration, will serve us well. Brown eyes are due to a deposit of brown pigment on the outer surface of the iris. The pigment was represented

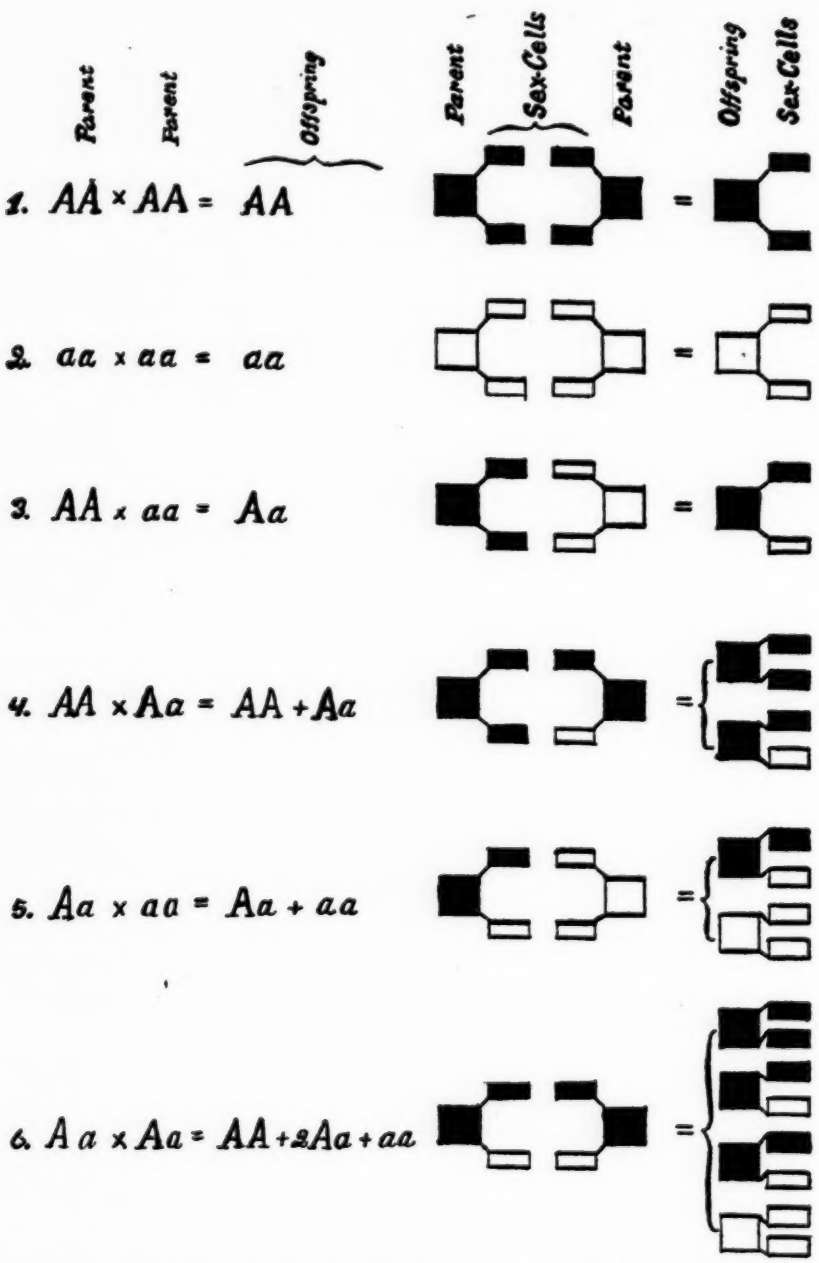


FIG. 4.—The six possible matings with respect to one unit characteristic (or an apparent pair of characters) are here indicated. *A* represents the determiner for the character; *a*, the absence of a determiner. Individuals are represented by squares; sex cells, by oblongs. Black indicates the presence of the character in the body of the individual or of the determiner in the sex cell; blank, the absence of either.

by a determiner in one or both of the sex cells that give rise to the individual. The blue eye is the opposite condition—blue only when no pigment develops, and pigment fails to develop only when neither parent has contributed a determiner for the same. The presence of a character is contrasted with its absence—the brown-pigmented condition is said to be dominant over the blue or non-pigmented condition, which is sometimes spoken of as "recessive." Of an apparent pair of opposing characters, one belonging to either parent, that one is dominant which appears in the offspring to the exclusion of the other. With some characters dominance is quite complete, as was the case with those of the peas with which Mendel experimented. He found, e.g., that when a pure or duplex tall individual was mated with a dwarf variety (the absence of tallness), all their offspring were tall like the one parent (Fig. 4, No. 3). When two of the offspring mated (in this case they were allowed to be self-fertilized), the individuals of the second generation were both tall and dwarf, in the proportion of three tall to one dwarf (Fig. 4, No. 6). The dwarf, when mated with dwarf, would produce only dwarf offspring (No. 2). Of the three tall individuals, one is duplex, and when mated with another, pure for tallness, would produce tall offspring only (No. 1). The other two talls are simplex like the parents.

In the case of eye-color, dominance is likely to be incomplete. If a boy receives a determiner for brown pigment from only one parent, his eyes will be brown; but if his brother receives a determiner from each parent, the eyes are likely to be browner. If dominance were complete no difference would be noticeable between the brown eyes of the two brothers. In this connection it should be said that the amount of pigment that is actually in the eyes has no effect on the offspring, for, I repeat, inheritance comes, not from the body, but only from the germplasm. In the case of these brown-eyed brothers the essential difference is that only half the sex cells of one will each contain a determiner for a certain amount of pigment while every cell of the other will contain a determiner.

We have but to recall the reduction division (Fig. 3) to see the probable place at which the segregation of determiners occurs. When a tetrad is formed by the union of two chromosomes, each of which bears a determiner for a given character, the determiner in each case divides into two. Then when the parts of a tetrad are finally distributed to the four sex cells, half of them will have received a determiner for the character from the individual's father and half from the mother. Or if a determiner has been contributed by only one of the parents, then only half the eggs or sperms will receive it.

When referring to a single characteristic, we think only, as the case may be, of the segregation of the determiner and its absence, of the

segregation of the determiners for the same character if each parent contributed one, or of the segregation of a determiner for a character of higher value from one of lower (which we will not here discuss). When, however, several characteristics or one's whole inheritance are under consideration, recombination of characteristics is also seen to be the result of the segregation of the many determiners. Recombination may be illustrated thus: Start with two boxes to represent a sperm and an egg. Let the boxes contain marbles which represent chromosomes, each of which for the sake of simplicity is made up of a single determiner for a character. Marbles are chosen for the illustration because they are units and can have no effect upon one another when mixed. Each marble in a box must, for our purpose, be unlike any other. Several marbles, however, in one box may resemble the same number in the other box, while all the others should differ. Now pour the contents of the two boxes together (this is comparable to fertilization). To illustrate what happens when the oöcyte or spermatocyte is ready to divide into the final four sex cells, divide the marbles into two equal parts, being sure that no two of the several pairs of marbles which are alike go into one group (reduction division). One may be sure that where many unlike marbles are concerned it is almost unthinkable that the two groups after the separation would be identical with the two with which we started. I will carry the comparison no further, since the foregoing represents what takes place from fertilization on to and including the formation of the new eggs or sperms, as the case may be; and the next step would again be fertilization and the bringing of one of these cells into relation with a new set of determiners. Fig. 5 is a diagrammatic representation of this same idea. The sex cell of one parent might furnish a child with a determiner each for tallness, brown hair, and strong lung tissue; the sex cell of the other parent, a determiner each for brown eyes, tallness, and normal mentality. The child's body in turn would show some shade of brown eyes and hair, be tall, have relatively strong lung tissue, and be probably of normal mentality, but in this last regard it is possible that since only one determiner was received it may under certain conditions fail to produce normal mentality, and hence some grade of feeble-mindedness

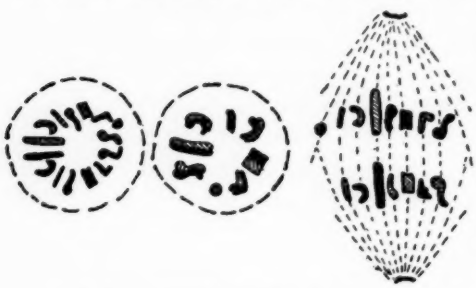


FIG. 5.—Recombination. The black forms represent the chromosomes contributed by one parent; the cross-hatched forms, the chromosomes contributed by the other parent. The last figure indicates possible recombinations in the cells resulting from a reduction division. (After Davenport.)

would result. This person's sex cells, however, will very likely show a combination of determiners which is different from that of the egg and sperm from which he arose. And were it possible for a sperm from each of the two kinds that would arise from a single spermatocyte to mate with an egg exactly like it from another strain, both the resulting children would be tall, but one might easily be brown-eyed, have light hair and strong lungs, and be mentally defective; the other might be blue-eyed, brown-haired, have weak lungs, and be normal as to mentality. These are only two of several possible combinations.

Other points of interest regarding heredity are (1) that an individual may be pure-bred or duplex with respect to one character, bad as well as good, and at the same time be simplex or nulliplex as to others. (2) Since sex is likewise a characteristic dependent on determiners, there is no possible way of influencing the sex of a developing embryo. (3) Barring a few sex-limited characters, as, for example, color-blindness, the two sexes are equal in their power to transmit heritable traits, and the inequality of a pair of parents is alone dependent on the fact that one comes from an inferior strain. (4) Like does not of necessity produce like (Fig. 5, No. 6), since in a simplex person a recessive character that does not appear in the body will be passed on in half of that individual's germ cells, and hence it is necessary to know the history of at least three generations in order to form an idea of what an individual may transmit to offspring. (5) If a family shows an abnormal character which is dominant, e.g., brachydactilism—a shortened condition of the fingers—it is perfectly safe for one to marry a normal individual from such a strain, since the normal condition is recessive, and hence his or her sex cells are pure for the normal; on the other hand, when an abnormal character is recessive, as is feeble-mindedness, an individual having inherited the condition will never be able to transmit anything else to his or her offspring; hence, if such a person marries it rests wholly with the other parent to contribute the determiner for mentality; then all the children will be simplex, and some may even show the defect in their own bodies. (6) And, finally, an important point regarding heredity is that conclusive studies must be made on every characteristic before it can be said just how each will act in inheritance; i.e., it is not possible merely to conclude that a character will be inherited in a way similar to one whose behavior is genetically understood.

In the light of all that has been said above, one can readily see why an understanding of the Mendelian principles regarding unit characters, determiners, and their segregation and recombination has during the past few years been of great value to plant and animal breeders. Also why it is that biologists are so confident that the permanent improvement of the human race is wholly dependent on heredity—on the perpetuation and recombination of desirable traits or characteristics.

III. The recent progress in determining the facts of heredity convinces scientists that human germplasm is already in possession of enough racial qualities of value to satisfy the most ardent eugenist. On the other hand, they are convinced that our greatest social ills—mental defectiveness, moral degeneracy, sex degeneracy, pauperism, drunkenness, and physical weaknesses—are likewise dependent on the nature of the germplasm. The inheritance of only a few human traits of both classes is thus far thoroughly understood, but the knowledge acquired already points the way to ultimate analysis of the human organism. Accordingly the problem of race improvement has never before appeared so complex and at the same time so hopeful. Granting that the numerous human unit characters will some day be so understood that it can be predicted in advance how each will be inherited, there then remains the problem of deciding which are advantageous to our civilization and which detrimental. To give various traits rank within their respective groups is, however, another question. To decide upon the fate of individuals, and especially those whose inheritance includes both valuable and highly undesirable traits, is, without doubt, the most difficult of all. Research, investigation, and education are accordingly of the utmost importance in establishing a science and practice of eugenics. Genetic research can accordingly be said to take first rank among eugenic measures. Education, or the diffusion of the knowledge of heredity, is the next essential. This must, in turn, be followed by exhaustive investigations of an economic and sociological nature in order to insure the correct application of biological principles. The masses must in turn be reached for the purpose of creating favorable public interest and sentiment that will insure voluntary eugenic practices and the enforcement of proper legislation against anti-eugenic agencies.

In connection with research and investigation I shall speak briefly of the present status along lines of heredity only. One department of the Carnegie Institution—the Station for Experimental Evolution, located at Cold Spring Harbor, New York, under the direction of Dr. C. B. Davenport—is carrying on various lines of work with reference to heredity and evolution. The Bussey Institute, located near Boston, under the direction of Dr. W. E. Castle, is giving special attention to experimental breeding of plants and animals with a view to determining the facts of heredity. Notable contributions to cytological knowledge are being made by Drs. Wilson, Morgan, and others of Columbia University. Investigators at various other universities and agricultural experiment stations are carrying on research work in many related lines.

The American Genetics Association (until recently called the American Breeders' Association) is the one and only society of national scope in America whose aim is to foster research in genetics and eugenics.

Of its three sections—Animal, Plant, and Eugenics—we are here concerned only with the latter. Dr. Davenport has been the secretary from the time of its establishment in 1910, and Drs. Jordan, Bell, Goddard, and Southard have served in various official capacities. At present there are at least ten research committees that are organizing or carrying on important lines of investigation. My one note of warning to those who desire to identify themselves with the true eugenics movement in America is to beware of aggregations of people under the name of "Society for Race Improvement," "Eugenics Conference," etc. You are not likely to find them supported and conducted by those whose training makes them leaders in the Eugenics Section of the American Genetics Association.

In close affiliation with the Eugenics Section is the Eugenics Record Office, with permanent headquarters at Cold Spring Harbor, New York. It is under the direction of Dr. Davenport and the superintendency of Professor H. H. Laughlin. The functions of this office are as follows: "(1) To serve eugenical interests in the capacity of repository and clearing-house; (2) to build up an analytical index of the traits of American families; (3) to train field workers to gather data of eugenical import; (4) to maintain a field force actually engaged in gathering such data; (5) to co-operate with other institutions and with persons concerned with eugenical study; (6) to investigate the manner of the inheritance of specific human traits; (7) to advise concerning the eugenical fitness of proposed marriages; (8) to publish results of researches." A mutual relation with the public is thus established. Individuals who take an interest in the subject have an authoritative source from which to obtain information. Many, in turn, may be able to contribute valuable data, chiefly by informing themselves on their own family histories and by filling in one of the various kinds of schedules furnished by the office.

In England, genetic research is now carried on at several universities and experiment stations. Eugenic research is under way at the Galton Eugenics Laboratory, and also under the auspices of the Eugenics Education Society. In other countries, I know of no specific provision that has been made for eugenic research.

The burden placed on society by the existence of the unfit—the mentally and physically diseased and the mental and moral defectives—is the problem that gives most general concern. More than one hundred millions of dollars are spent annually in the United States because of bad germplasm. Approximately five persons in every one hundred of our population are through defectiveness, degeneracy, and sickness incapacitated for work and other normal activities. The state of New York spends one-fourth of its annual income on charitable and corrective institutions; one-seventh goes to care for the insane alone. In addition,

more is spent by the private charities than from the public funds in this state. England and Wales spend about seventy million dollars annually on "poor relief." It must, moreover, be taken into account that many normal people are drawn away from productive pursuits to care for the classes named. Then when we consider how many individuals, on an average, depend either directly or indirectly on each wage-earner, we can better realize what this burden of the unfit means to the families of the wage-earning and salaried classes, and of small landowners and small business people.

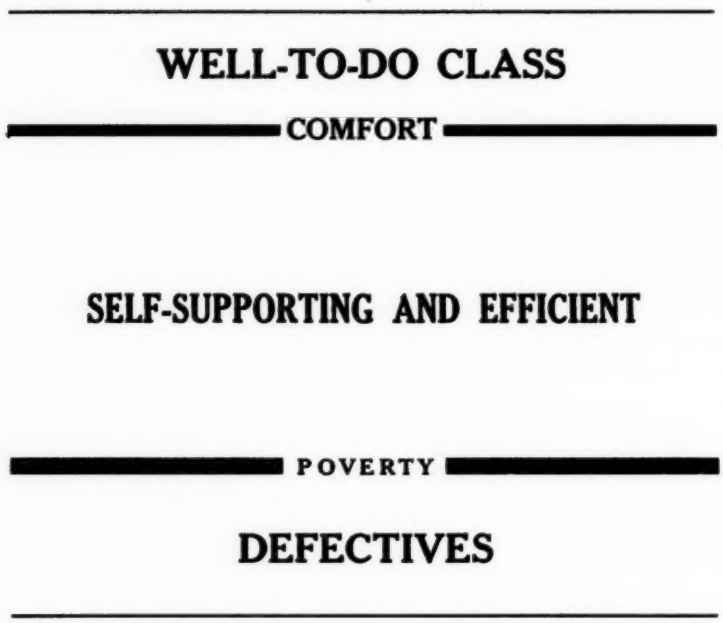


FIG. 6.—Classes of society. (After Lidbetter's description.)

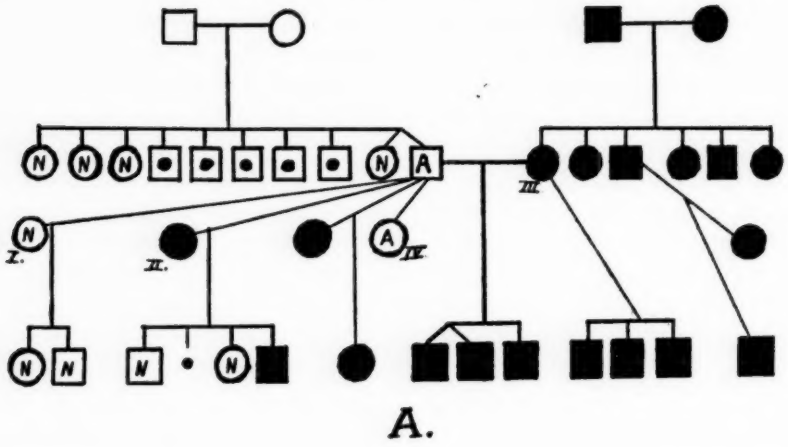
Society may be said to consist of three groups—the small well-to-do class, the large self-supporting and efficient group, and the dependent, defective group (Fig. 6). Generally speaking, the mass of those below the poverty line are there because of defectiveness or degeneracy—they are chiefly those who have never reached a normal mental development or those of pauper stock. It is admitted that at any given time a few of those below the poverty line are there because of misfortune—unusual sickness, loss of property, etc.; they are suffering from poverty but not from pauperism. Mr. E. J. Lidbetter, in a valuable article on nature and nurture, calls attention to an attempt made on a large scale in London to benefit the lower class of the population. In 1889 an area of 14½ acres on the east side, conspicuous for its miserable and insanitary

conditions, was cleared and rebuilt. The result was that the five thousand or more persons who were dislodged entered the surrounding neighborhoods, which have through them since become as undesirable as the original area. None of them returned to the new accommodations. Regarding this experiment Lidbetter says, "Many of the survivors of that cleared area have been known to me during the past ten years and I know them as a mass of broken and twisted human wreckage whom no external influence could improve." His biological knowledge together with his experience in social work led him to insist that "blood" must be taken into account, that improvement cannot be imposed from without, and he further says, "the measure of the response to external influence must ultimately become the test between good and bad stock."

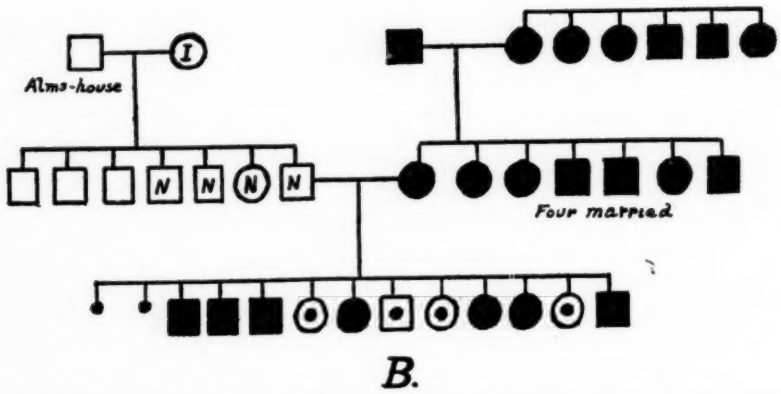
Genetically and economically, we can hardly at present be said to be in a position to take a stand regarding the social control of any of the burdening classes except the feeble-minded. Various facts especially warrant society in taking steps to protect itself in this regard. It is the one class of the unfit about which there is most accurate information from the standpoint of heredity. Dr. Goddard, as the result of careful investigation, states positively that not less that 65 per cent of the feeble-minded have inherited the condition. Others have placed the percentage even as high as 90. It is definitely established that a pair of feeble-minded parents give rise only to feeble-minded children (Fig. 7). Their birth-rate is far in excess of the average for normal people. They constitute a class that is intimately associated with pauperism, alcoholism, prostitution, venereal diseases, and crime. And lastly, they are destined to become still more burdensome, since our civilization is developing in such a manner that success is constantly becoming more dependent on mental fitness. Hence of all investments that the provident classes can make for future generations none is more promising of returns than are the funds spent on eliminating strains of feeble-mindedness from the population.

The feeble-minded, as a class, includes those human beings that are lacking in several or many human traits which are considered necessary to our civilization. They are the real mental defectives and are not to be confused with the insane, epileptics, and others who may have reached a normal development and then became diseased. The idiot, at one extreme of the group of the feeble-minded, may be absolutely incapable of attending even to his physical wants, and is recognized by all at a glance. At the other extreme, however, is the high-grade imbecile, who from appearance may give no indication of his mentality, and may even be likable and pleasing in features. The Binet-Simon test for determining intelligence is adapted to normal children up to the age of fifteen and would, if given to a high-grade imbecile, show him to be four years or more below the mentality of a normal child of the same age.

The germplasm is either entirely without certain determiners for the normal mental condition or, if simplex, the character may appear in a weakened form; in either instance the individual can reach only a limited development. Such persons may be teachable—they may even



A.



B.

FIG. 7.—Feeble-mindedness. Divisions A and B are shown together because the central female in each are sisters. Males are represented by squares; females, by circles. Black indicates that the individuals are feeble-minded; only those marked *N* are known to be normal; the black dot indicates a miscarriage, but if within a circle or square it indicates that the boy or girl died in infancy. The central male individual in Division A is of unknown parentage, is alcoholic, has been married to four women, and in addition has mated with a fifth. (After Goddard.)

be made self-supporting—but their self-control can never be relied on. The high- and low-grade imbeciles constitute the class from which are recruited many juvenile offenders—those who start fires, those who commit petty thefts, those who are repeatedly moral offenders, and those who even commit murder through their lack of self-control or at

the suggestion of others. These, moreover, are the ones who intermarry in many cases with the lower strata of the self-supporting group, or otherwise mate with mentally normal people. Strains normal as to mentality are thus contaminated. Even should the offspring themselves be normal, they would nevertheless be simplex as to their sex cells. Matings between two strains which bear the hidden defect are not uncommon, and thus the appearance of an occasional defective child in so-called normal families (Fig. 4, No. 6).

It is estimated that in the United States there are easily 300,000 persons who are feeble-minded, and fully 200,000 more are not sufficiently intelligent "to compete with their fellows on equal terms and thereby to earn livelihoods." There is no law in any of our states for the compulsory commitment of individuals of this class to institutional care. I merely mention, in passing, that England, through the Mental Deficiency act, 1913, is now in position to make a beginning in this matter of retention. In the United States less than 10 per cent of the feeble-minded are in institutions and then only for the purpose of training them or as a charity, not as a protection to society, for it is often just about the time that they are able to reproduce themselves that they leave the institution. Consequently of the 90 in every 100 who are at large, many thousands of the younger ones are indiscriminately associated with the normal children in our public schools, where they are a constant source of trouble for teachers, and where normal children are prevented from progressing as rapidly as they would if the schools were free from the mental defectives. And the danger of normal children being led into immoral habits through contact with irresponsible, degenerate children is by no means fully realized by all parents.

After the public schools, the courts offer probably the next most important place where the feeble-minded may be found, and from which they disappear for a time to help fill our prisons and reformatories. I have already spoken of crimes committed by the feeble-minded, and the shame is that such persons are punished according to the nature of the crime. Little has been gained and in due course of time they again appear before the courts. Why not begin to deal more intelligently with this problem by taking into consideration the mentality of such persons? If mentally defective offenders were sent for life to colonies for the feeble-minded society would be doubly protected, both from the individuals themselves and from probable offspring with similar traits.

The feeble-minded of both sexes found in the almshouses constitute a third large group. In order to impress upon you the terrible consequences of allowing especially girls and women to be kept in the many county poorhouses, which they enter and leave at will, I will quote from Goddard. He "examined eight women in one of the best almshouses to be found. All of these had given birth to feeble-minded

children within six weeks of each other. The superintendent of that institution said that of 105 children born there during a period of five years, 102 were feeble-minded." Instances are, moreover, known of three generations of such stock in the same institution. Fig. 8 illustrates the poorhouse, repeating type.

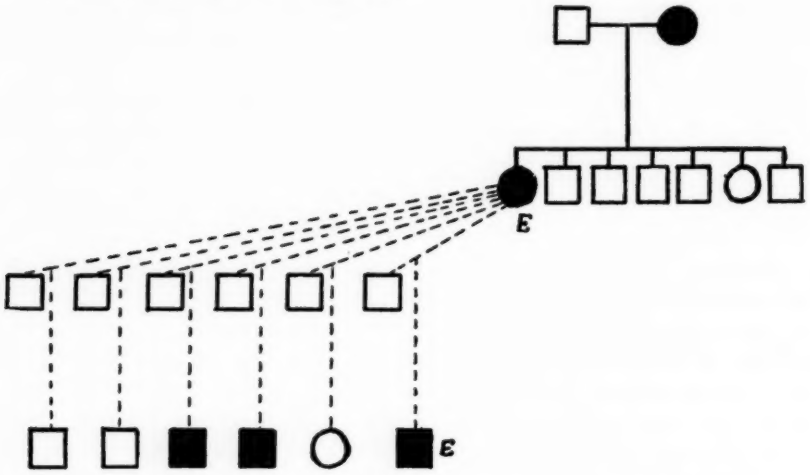


FIG. 8.—The feeble-minded woman of the almshouse. Black indicates feeble-minded individuals; there is no information regarding the remaining individuals. The central figure is a feeble-minded, epileptic, syphilitic woman who has mated with six different men, one of them colored. (After Davenport and Weeks.)

I shall here mention only two of several methods that have been suggested for the elimination of the unfit and that can be applied to the feeble-minded. They are permanent custodial care and sterilization. The initial cost of providing for the custodial care of such large numbers as are to be found in each state would of course be very great; hence the need for using all legitimate methods of elimination. Notable experiments in colonization are in progress at Templeton Farm Colony in Massachusetts and at Letchworth Village in New York. The results of permanent custodial care are well illustrated by what has been accomplished in Aosta, Italy. There cretinism—a form of idiocy that is accompanied by physical degeneracy and deformity, and usually by goiter—was fast contaminating the normal population which wars had spared. Permanent care was begun in 1890, and now scarcely an afflicted person is to be found at large.

Sterilization, or the unsexing of either men or women, by a simple operation which consists in sectioning and ligating one part of the duct that conveys away the sex cells from their respective glands, or in removing a small section of the duct, is advocated as a means of checking the rapid increase of the unfit. Indiana in 1907 legalized the steril-

ization of "confirmed criminals, idiots, imbeciles, and rapists." Since then twelve or more states have passed somewhat similar laws. Regarding these there are two questions: Is the method physiologically efficient? and Will they stand the test of the courts? A few test cases have been decided in favor of the law. With respect to the efficiency of the method, it may be said that a committee from the Eugenics Section of the American Genetics Association has during the past two years been carrying on an extensive investigation. Its report is now in press and will appear as *Bulletin Nos. 10a* and *10b* of the Eugenics Record Office.

The problem of the feeble-minded is so great and so complex that a step of great benefit to any state will be the establishment of a mental deficiency bureau that at some future time could be made a part of a state eugenics commission. Its first essential is that the trained staff contain a fair proportion of geneticists. Secondly, it should be stipulated that at least two years be allowed for careful investigation of the local situation before such a bureau advise as to legislation, or take upon itself executive power. In addition to the study of family histories, one of its most important tasks would be early to devise some method, or approve an existing one, as for example the Binet-Simon measuring scale of intelligence, whereby mentality may be determined. Through the work of a trained staff a state can be brought to realize better its needs and to make proper provision for dealing with the problem. Even where sterilization laws have been enacted, only a small percentage of the feeble-minded of a state come within its scope. A careful registration of mental defectives would greatly aid the courts in the proper disposal of those that appear before it; the various boards of education over the state would thus sooner be induced to bring about segregation in the public schools on the basis of mentality; isolated communities in remote regions, difficult of access, would thus be located, where, through inbreeding, centers of degeneracy have formed. And lastly, a campaign of education can be carried on by such a bureau that will lead its people to see that as matters now stand they are paying the price, and that even custodial care is a good business proposition; also one that will lead its people to demand wise laws in this matter and to aid in their enforcement.

The federal government is not exempt from responsibility in eugenic matters. To it falls the task of permitting only physically and mentally fit immigrants to enter our ports. The limited facilities of the immigration service will not long suffice when once the people are awake to the importance of this question. It is just as essential to know the nature of the immigrant's sex cells as to know the condition of his or her body at the time of entrance. In consequence of this fact Davenport has repeatedly brought forth the argument that it is highly necessary that provision be made for learning the family histories of prospective

immigrants if we are to be able to accept only such as are likely to be the starting-point for desirable strains on our soil. Even with our present law it would be interesting to know how often information and aid are given by citizens to immigration officials that will lead to deportation, within three years, of such persons as prove to be undesirable.

The anti-eugenic effects of wars, especially such as are waged for principle, are repeatedly commented upon by David Starr Jordan, both in writings and from the platform. His investigations lead him to insist that "there is not a nation that is today what it might have been if it had chosen its best for survival instead of slaughter." His interest in eugenics explains in great part the reason why he is such an earnest advocate of peace. Benjamin Franklin's expression, "Wars are not paid for in war time; the bill comes later," is highly appropriate in this connection.

Mention will be made of only a few other suggested eugenic problems. (1) The cost of living and other economic considerations bear a most intimate relation to the question of deferred marriage, and particularly to the rearing of a family, by those intent on higher education, getting a start in the professions, entering on army and navy careers, accepting government posts, etc. Prohibitions against marriage in the case of women teachers, in the case of priests and clergy, and even in the case of undergraduates of colleges also come in this category. (2) Among wage-earners, children cannot, as formerly, be considered an economic asset. The limitation of the size of families has been repeatedly shown to bear a definite relation to the economic status of honest, thinking people. Accordingly there arises the question of determining in how far child-labor laws, compulsory education, old-age pensions, etc., are really eugenic in nature. (3) Should the nature of inheritance be made a special factor in matters of health insurance, compensation under liability acts, taxes, etc.; i.e., if diseased strains see fit to perpetuate themselves should they not bear a greater part of the financial burden which they are likely to place on society? (4) With the great advance in surgical obstetrics, what will be the result of perpetuating many strains whose women are so constituted that childbirth is not a normal process? (5) The government, particularly of cities and counties, is most intimately affected by the question of outdoor relief—"a corruption fund of the worst sort," as it has been called. The problem of who holds the balance of power in local politics has a very definite eugenic aspect.

Regarding positive eugenics for the present little need be said. Because of the interrelation and dependence of so many elements in the make-up of society, it is believed by many that the gradual correction of important negative practices, together with the education it is hoped the masses will in time receive relative to the subject of heredity, will go far toward bringing about voluntary practices of a positive nature.

In conclusion, a word about education. In view of the fact that epoch-making researches in genetics are in progress, and that there is such a general awakening to social conditions, the next few years seem to be a most critical time for the diffusion of accurate ideas regarding eugenics. Formulating methods for the correct application of the principles of heredity in the case of human beings rests, however, chiefly with groups other than the biologists who discover the principles—with physicians, social workers, economists, psychologists, educators, ministers, lawmakers, conscientious parents, and other good citizens. Hence the overwhelming need of informing people generally, at the earliest opportunity, concerning the present knowledge of heredity, and of impressing upon them that eugenics is the study of human inheritance and the application of its principles through socially controlled agencies, and not a thousand and one things that now pass under that name, solely because of ignorance as to heredity. Even physicians, the class whose opportunities are greatest for disseminating correct ideas of parenthood, are, with rare exception, not prepared to give trustworthy advice as to inheritance. Very few of the medical curricula, as yet, contain courses on these new subjects of genetics and eugenics.

In association meetings, clubs, churches—in fact, wherever people gather—eugenics is the topic of the hour. Yet the foundation principles of heredity are seldom mentioned except in scientific bodies, because so few understand the two difficult phases of biology—Mendelian inheritance and cell structure and activity—and these persons are chiefly occupied in academic and research work. Ordinarily ideas regarding anti-eugenic practices and hoped-for results from so-called eugenic measures constitute the burden of most discussions. Resolutions, demands, and legislation, in most instances, can more logically follow in the wake of the proper kind of education. Hence the foregoing recommendation that the local chapters of the Association of Collegiate Alumnae give serious consideration to this subject before the next biennial meeting of the Association. College women are usually in a most advantageous position in their respective localities to aid in the diffusion of knowledge. For this reason this discussion has been largely in the nature of an appeal for correct education in matters of eugenics.

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ADDRESSES

THE EUGENICS RECORD OFFICE, Cold Spring Harbor, Long Island, New York, publishes memoirs, bulletins, and reports; furnishes eugenical information on request; desires co-operation in filling in schedules.

THE AMERICAN GENETIC ASSOCIATION, Washington, D.C., publishes the *Journal of Heredity* (*American Breeders Magazine* until January, 1914).

THE TRAINING SCHOOL, Vineland, New Jersey, has departments for training the feeble-minded, research, and education.

THE VOLTA BUREAU, Washington, D.C., a repository for information on the deaf.

THE EUGENICS EDUCATION SOCIETY, Kingsway House, Kingsway, W.C., London, publishes the *Eugenics Review;* issues pamphlets and reprints; is engaged in educational work; arranged the first international eugenics congress.

The Thirty-Third General Meeting *of the* Association of Collegiate Alumnae *at* San Francisco, Aug. 16-24 inclusive, 1915

Tentative Program

Monday, August 16: Council meeting; in the evening the opening reception in the California Building on the Exposition grounds.

Tuesday, August 17: Business meetings in the Civic Center Auditorium.

Wednesday, August 18: Conferences; in the evening an open meeting (speakers will be announced later).

Thursday, August 19: Meetings at the University of California, Berkeley. In the afternoon three hundred and fifty women students will repeat the *Parthenia*.

Friday, August 20: Business meetings at the Civic Center Auditorium. In the evening a banquet at the Fairmont Hotel.

Saturday, August 21: "Collegiate Alumnae Day" on the Exposition grounds. Members will remain for supper and an illumination.

Monday, August 23: Council meeting. In the evening an excursion to Mt. Hamilton Observatory and the great telescope.

Tuesday, August 24: An invitation is extended to the members of the Association to visit the San José Branch at San José.

The official party will leave ***Chicago* August 2, 1915; *Minneapolis* August 3, 1915,** on its own special Pullman train—including dining and observation cars. The route will be through the Canadian Rockies with stops and sight-seeing trips at Lake Louise, Laggan, and Banff; thence through the Canyon of the Frazier River to Vancouver and by steamer to Victoria; from Victoria via the Puget Sound steamers to Seattle, whence another special train to San Francisco will pass through the famous Mt. Shasta region. Stops for sight-seeing will be made at Tacoma and Portland in addition to the places already named. This party will reach San Francisco August 15, 1915.

The price from Chicago—including transportation, Pullman berths, all sight-seeing trips, carriages, motors, steamship fares, 150 lbs. of baggage and its transfers, the best hotels on the European plan, two in a room—to San Francisco (15 days' travel) and return railroad transportation (choice of four routes) to Chicago will be approximately $161.00.[1]

To obtain these special rates and accommodations we must have at least *one hundred* members in the party.

Friends of members and delegates may be included in the party upon application to the General Secretary and the payment of a small registration fee.

The prices quoted above do not include meals. So many of our members prefer to club together in dining-cars and hotel restaurants that it seemed unwise to increase the cost for each person by $2.75 per day, the amount allowed for meals. Coupons for meals may be purchased at the rate of $0.75 for breakfast, $1.00 for luncheon, $1.00 for dinner, and are redeemable at face value if not used.

Hotel rates in San Francisco will vary from $2.00 to $5.00 a day. Arrangements will be in the hands of the Chairman of the Housing Committee of the California Branch.

MRS. E. J. MOTT,
2628 Baker Street,
San Francisco, California

For *return routes*, see inside cover of January *Journal*, and later *Journals*. Further information with regard to hotel accommodations will appear in the April and May *Journals*.

For further information apply to VIDA HUNT FRANCIS, *General Secretary*, 1225 Spruce Street, Philadelphia, Pa.

[1] Prices cannot be absolute at this date—but will in no case exceed the sum stated.

NOTICE

Additional copies of this number of the Journal of the Association of Collegiate Alumnae containing *Heredity and Problems in Eugenics, A Report of the Subcommittee on Eugenics,* may be secured by addressing the University of Chicago Press, 5750–58 Ellis Avenue, Chicago, Illinois. Price 25 cents, postpaid.